calculating a cyclic correlation matrix using a second cycle frequency of a second modulated signal whose modulation system is different from that of said first modulated signal received by said array antenna; and

estimating the directions of arrival of said first modulated signal and said second modulated signal using eigenvalues and eigenvectors of said calculated correlation matrices.

REMARKS

By the present amendment, claims 1-8 have been amended to eliminate "means for" terminology and claim 9 has been amended to eliminate "steps of" terminology to thereby broaden the scope of the claims.

The Examiner is respectfully requested to enter the foregoing amendment prior to an examination of the above-identified patent application.

Should there be any questions, the Examiner is invited to contact the undersigned at the below-listed telephone number.

Respectfully submitted,
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July 30, 2001
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P20968.A01

MARKED UP COPY OF THE CLAIMS

1. (Amended-Marked Up Copy) A direction of arrival estimator comprising:

an array antenna made up of a plurality of antenna elements that receives a signal from a communication terminal apparatus;

a first correlation detecting [means for calculating] system that calculates a cyclic correlation matrix using a first cycle frequency of a first modulated signal included in the reception signal of said array antenna;

a second correlation detecting [means for calculating] system that calculates a cyclic correlation matrix using a second cycle frequency of a second modulated signal whose modulation system is different from that of said first modulated signal included in the reception signal of said array antenna; and

a direction of arrival estimating [means for estimating] system that estimates the directions of arrival of said first modulated signal and said second modulated signal using eigenvalues and eigenvectors of the correlation matrices calculated by said first and second correlation detecting means.

2. (Amended-Marked Up Copy) The direction of arrival estimator according to claim 1, wherein the first correlation [detecting means] system calculates a cyclic correlation matrix of a spread spectrum modulated signal using a frequency decided from the chip rate of the spread spectrum modulated signal as the first cycle frequency.

3. (Amended-Marked Up Copy) The direction of arrival estimator according to claim 1, wherein the second correlation detecting [means] system calculates a cyclic correlation matrix of the second modulated signal by detecting the second cycle frequency of the second modulated signal from the reception signal.

4. (Amended-Marked Up Copy) The direction of arrival estimator according to claim 2, further comprising a data storing [means for storing] system that stores the reception signal, wherein the first correlation detecting [means] system calculates a cyclic correlation matrix using the storage data of said data storing [means] system.

5. (Amended-Marked Up Copy) The direction of arrival estimator according to claim 1, wherein when there is a plurality of eigenvalues, the direction of arrival estimating [means] system uses absolute values of said eigenvalues to distinguish magnitudes thereof.

6. (Amended-Marked Up Copy) The direction of arrival estimator according to claim 1, wherein the second correlation detecting [means] system detects a plurality of cyclic frequencies from the reception signal and calculates a cyclic correlation matrix of a plurality of second modulated signals.

7. (Amended-Marked Up Copy) The direction of arrival estimator according to claim 1, comprising N linear array antennas [(N: natural number)] where N is a natural number, which are installed in such a way that the direction of the normal to each array

antenna forms an angle of 360° /N with one another, wherein the direction of arrival estimating [means] system estimates the directions of arrival of the first modulated signal and second modulated signal using the reception signal of said linear array antennas and estimates their true directions of arrival for all directions by comparing the estimation results for each of said linear array antennas.

8. (Amended-Makred Up Copy) A base station apparatus equipped with a direction of arrival estimator, said direction of arrival estimator comprising:

an array antenna made up of a plurality of antenna elements that receives a signal from a communication terminal apparatus;

a first correlation detecting [means for calculating] system that calculates a cyclic correlation matrix using a first cycle frequency of a first modulated signal included in the reception signal of said array antenna;

a second correlation detecting [means for calculating] system that calculates a cyclic correlation matrix using a second cycle frequency of a second modulated signal whose modulation system is different from that of said first modulated signal included in the reception signal of said array antenna; and

a direction of arrival estimating [means for estimating] system that estimates the directions of arrival of said first modulated signal and said second modulated signal using

eigenvalues and eigenvectors of the correlation matrices calculated by said first and second correlation detecting [means] system.

9. (Amended-Marked Up Copy) A direction of arrival estimation method comprising [the steps of]:

calculating a cyclic correlation matrix using a first cycle frequency of a first modulated signal received by an array antenna;

calculating a cyclic correlation matrix using a second cycle frequency of a second modulated signal whose modulation system is different from that of said first modulated signal received by said array antenna; and

estimating the directions of arrival of said first modulated signal and said second modulated signal using eigenvalues and eigenvectors of said calculated correlation matrices.